



Hepatic Artery Reconstruction Using 3-in-1 Segmental Resection in Pediatric Living Donor Liver Transplantation: A Case Report and Literature Review

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ABSTRACT

We report a transplant of the left lateral liver segments with 3 arteries for a pediatric recipient from a living donor. A 6-month-old female infant was diagnosed with liver cirrhosis secondary to biliary atresia and scheduled for living donor liver transplantation (LDLT; mother as donor). Left lateral hepatectomy was performed at the donor site. The dissection of the left hepatic artery (HA), which was divided immediately after its origin, showed 3 branches for segments II, III, and IV. The arteries for segment II, segment III, and segment IV were anastomosed to the recipient HA. No postoperative complications were observed. The outcome of this case demonstrates that left lateral segments with 3 arteries can be successfully used if proper surgical techniques are applied. From this experience we can recommend “3-in-1 segmental resection” in the donor can be safely done by skilled microvascular surgeons and this technique should be considered for selected cases where multiple tiny arteries supply the graft.

LIVING donor liver transplantation (LDLT) is accepted as treatment for children with end-stage liver disease and has brought about a significant reduction in wait-list mortality [1,2]. Usually the left lateral segments are used for pediatric recipients. The length and diameter of the vessels of these grafts may call for complex reconstruction including interposition grafts and anastomoses with arteries other than the recipient hepatic artery (HA) [3–6]. With microsurgical techniques, the vascular anatomy has become a rare reason for excluding someone from donation. This report describes a transplant of a left lateral segmental graft with 3 arteries from a living donor.

CASE REPORT

A 6-month-old female infant weighing 6.7 kg and suffering from liver cirrhosis secondary to biliary atresia was transferred for transplantation. In addition to severe hyperbilirubinemia with rapidly deteriorating liver function, ascites, and portal hypertension, the child had an atrial septal defect with laminar left-to-right shunt but no impact on overall cardiac function. Biliary atresia was diagnosed at the age of 2 months, and Kasai procedure was performed when she was 75 days old.

Serum bilirubin on admission was 206 $\mu\text{mol/L}$, aspartate aminotransferase was 72 U/L, alanine aminotransferase was 48 IU/L, alkaline phosphatase was 257 U/L, and c-glutamyl transferase

was 618 U/L. Hemoglobin was 96 g/L, white blood cell count was $17.41 \times 10^9/\text{L}$, and platelet count was $310 \times 10^9/\text{L}$. The patient tested positive for cytomegalovirus IgG and IgM but negative for Epstein-Barr virus IgG and IgM. Prothrombin time was 21.5 seconds. Computed tomography with contrast media demonstrated normal vascular anatomy of the liver.

The donor was the patient's mother, who was 30 years old and weighed 62 kg. Her liver function tests were normal. Calculated volume of segments II and III was 289 cm^3 . Computed tomography angiography demonstrated early division of the left HA into 3 branches for segments II, III, and IV. Because the child's condition deteriorated rapidly and no deceased donor became available, we decided to accept the mother as a donor despite her variant arterial anatomy.

Donor Procedure

Through a short medioventral incision with median extension, hilar dissection was begun with a cholecystectomy followed by

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cholangiography via the cystic duct, which demonstrated one bile duct for segments II and III at the level of transection. Then the left HA, which divided immediately after its origin, and the 3 branches were carefully dissected, as was the left portal vein and the left hepatic vein. Parenchymal transection just right of the falciform ligament was performed with a cavitation ultrasonic surgical aspirator (CUSA, Valleylab, Boulder, Colo, USA) without any blood loss. After heparinization each artery was clamped and divided. The arteries had a diameter of 1, 1, and 2 mm, respectively. After clamping and severing the remaining vascular structures, the graft was removed and flushed at the back table with 500 mL University of Wisconsin solution via the portal vein; 50 mL University of Wisconsin solution was manually injected into each artery and the bile duct was rinsed with the same solution.

All the approaches and potential problems were discussed with the donor and her family before and during the operation. Informed consent also obtained.

Recipient Procedure

Hepatectomy was performed through a bilateral subcostal incision while preserving the caval vein. After reconstructing the graft hepatic vein with a common trunk consisting of the left and middle hepatic veins of the recipient using 5-0 polydioxanone (PDS, Ethicon, Germany) and anastomosing the portal vein using 6-0 polydioxanone running sutures, the graft was reperfused. For

arterial reconstruction a microscope (Varioskop S6; Zeiss, Jena, Germany) with 12 \times magnification was used. The arteries for segment II, III, and IV were anastomosed to the recipient HA with a diameter of 2 mm using 9-0 (polyamide 6-6; Fig 1). Excellent flow was detected by color Doppler ultrasound (Fig 2). Finally, a hepaticojejunostomy was performed for biliary drainage using 6-0 polydioxanone interrupted sutures.

Recipient Outcome

Using tacrolimus-based triple-drug immunosuppression, the post-operative course was completely uneventful. Liver function tests normalized within 2 weeks. Initially the child was heparinized (prothrombin time levels were maintained around 15 seconds) for 1 week, and then she was given 20 mg/d acetylsalicylic acid for 1 year. Regular color Doppler sonography revealed normal flow, resistance, and pulsatility index in all arteries. Now the child is well with normal graft function.

Donor Outcome

There were no complications in the present case. Liver function tests normalized within 1 week. The donor is currently doing well and has returned to her preoperative activities of daily living.

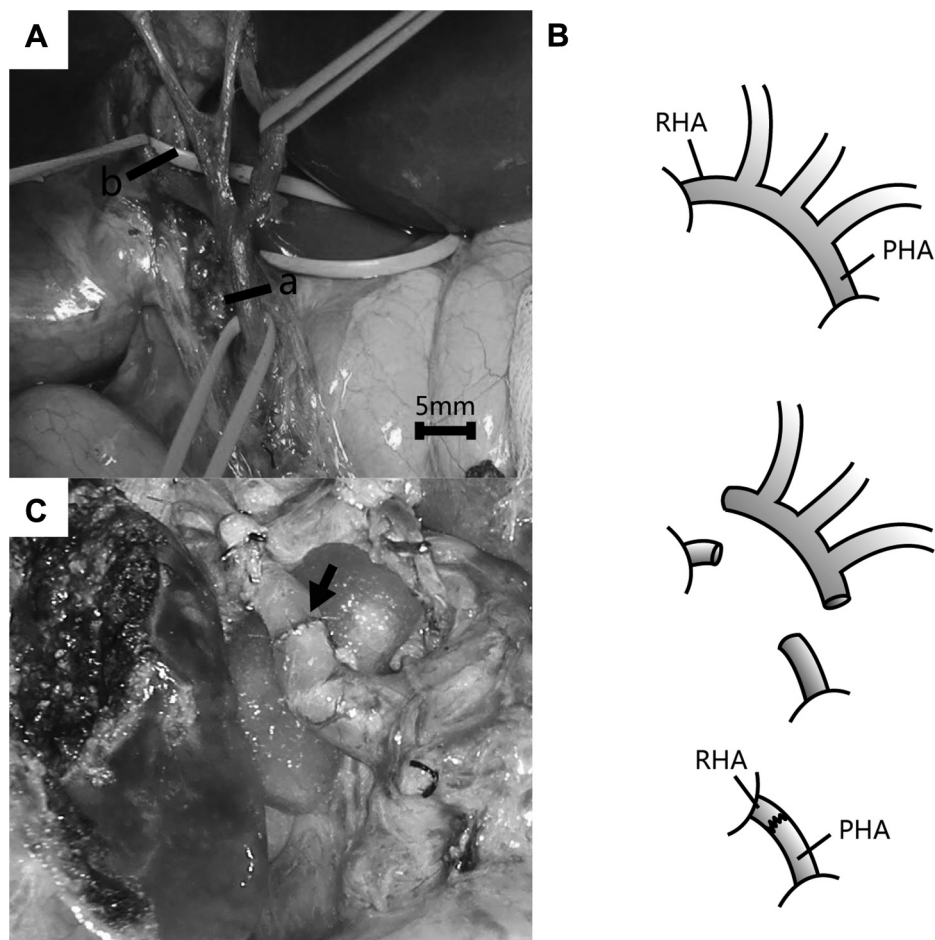


Fig 1. The 3-in-1 segmental resection in case of triple tiny arteries in left liver grafts. During donor operation, the hepatic artery (HA) was transected at the point of proper HA (a) and right HA (b) (A). Remnant proper HA (PHA) and the right HA (RHA) were anastomosed under microscope (B, C).

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